

1. A method of dispensing a liquid as an atomised spray comprising the steps of

supplying a non-pressurized liquid to and maintaining the liquid in contact with a rear surface of a vibratable perforate membrane defining an array of holes, each hole being flared such that the cross-section of each hole narrows in a direction from the rear surface towards a front surface of the membrane,

and vibrating the membrane such that droplets of the liquid are dispensed through the flared holes as an atomised spray.

2. A method of dispensing a liquid as an atomised spray comprising the steps of

maintaining the liquid in contact with a rear surface of a vibratable perforate membrane comprising an electroformed metal sheet defining an array of holes, each hole being flared such that the cross-section of each hole narrows in a direction from the rear surface towards a front surface of the membrane, the diameter of the holes at the front surface being less than or equal to 20 microns,

and vibrating the membrane such that droplets of the liquid are dispensed through the flared holes as an atomised spray solely by the vibrating of the membrane.

3. A method of dispensing a liquid as an atomised spray comprising the steps of

maintaining the liquid in contact with a rear surface of a perforate membrane defining an array of holes, each hole being flared such that the cross-section of each hole narrows in a direction from the rear surface towards a front surface of the membrane, said membrane being stiffened by means of a grid of support elements, and said membrane having a sheet defining the array of holes and having thickened portions constituting the support elements,

and vibrating said membrane with the grid of support elements and flared hole,

wherein, the vibrating of said membrane causes the liquid to be emitted from said membrane such that droplets of the liquid are dispensed through the holes as an atomised spray.

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at 4. A method [as claimed in claim 3] of dispensing a liquid as an atomised spray comprising the steps of

maintaining the liquid in contact with a rear surface of a perforate membrane defining an array of holes, each hole being flared such that the cross-section of each hole narrows in a direction from the rear surface towards a front surface of the membrane, said membrane being stiffened by means of a grid of

support elements, and said membrane having a sheet defining the array of holes and having thickened portions constituting the support elements.

and vibrating said membrane with the grid of support elements and flared hole such that droplets of the liquid are dispensed through the holes as an atomised spray

wherein wetting of the front surface of the membrane by the liquid is inhibited by means of a liquid repellant surface coating applied to the front surface.

5. A method [as claimed in claim 3] of dispensing a liquid as an atomised spray comprising the steps of

maintaining the liquid in contact with a rear surface of a perforate membrane defining an array of holes, each hole being flared such that the cross-section of each hole narrows in a direction from the rear surface towards a front surface of the membrane, said membrane being stiffened by means of a grid of support elements, and said membrane having a sheet defining the array of holes and having thickened portions constituting the support elements.

and vibrating said membrane with the grid of support elements and flared hole such that droplets of the liquid are dispensed through the holes as an atomised spray

wherein the liquid comprises a pharmaceutical product in aqueous solution or suspension.

6. A method [as claimed in claim 3] of dispensing a liquid as an atomised spray comprising the steps of

maintaining the liquid in contact with a rear surface of a perforate membrane defining an array of holes, each hole being flared such that the cross-section of each hole narrows in a direction from the rear surface towards a front surface of the membrane, said membrane being stiffened by means of a grid of support elements, and said membrane having a sheet defining the array of holes and having thickened portions constituting the support elements,

and vibrating said membrane with the grid of support elements and flared hole such that droplets of the liquid are dispensed through the holes as an atomised spray

wherein the liquid comprises a pharmaceutical product and the holes have a diameter at the front surface in the range 3 to 7 microns.

7. Dispensing apparatus for use in dispensing liquid as an atomised spray comprising

a vibratable perforate membrane defining an array of holes and having a front surface and rear surface, liquid supply means for supplying the liquid in contact with the rear surface, and

vibrating means operable to vibrate the membrane relative to the liquid supply means such that droplets of the liquid are dispensed through the holes as an atomised spray,

wherein each hole is flared such that the cross-section of each hole narrows in a direction from the rear surface towards the front surface.

8. Dispensing apparatus for use in dispensing liquid as an atomised spray comprising

a vibratable perforate membrane comprising an electroformed metal sheet defining an array of holes and having a front surface and a rear surface,

liquid supply means for supplying the liquid in contact with the rear surface, and

vibrating means operable to vibrate the membrane relative to the liquid supply means such that droplets of the liquid are dispensed through the holes as an atomised spray,

wherein each hole is flared such that the cross-section of each hole narrows in a direction from the rear surface towards the front surface and the holes have a diameter at the front surface less than or equal to 20 microns.

9. Dispensing apparatus for use in dispensing liquid as an atomised spray comprising

a perforate membrane defining an array of holes and having a front surface and a rear surface,
liquid supply means for supplying the liquid in contact with the rear surface, and

- 5 vibrating means operable to vibrate the membrane such that droplets of the liquid are dispensed through the holes as an atomised spray;
wherein each hole is flared such that the cross-section of each hole narrows in a direction from the rear
10 surface towards the front surface, wherein the perforate membrane comprises a sheet defining the array of holes through which liquid is dispensed in use and support means supporting the sheet, and wherein said support means comprises a grid of
15 support elements.

10. Dispensing apparatus as claimed in claim 9 wherein the support elements are formed integrally with the sheet and comprise thickened portions thereof.

11. Dispensing apparatus as claimed in claim 9
20 wherein the grid of support elements comprises a plurality of circumferentially spaced radially extending elements connected to an annular support element defining a central portion of the sheet.

12. Dispensing apparatus as claimed in claim 9
25 wherein the front face of the perforate membrane comprises a liquid repellant surface.

13. Dispensing apparatus as claimed in claim 9 wherein the perforate membrane comprises an electroformed metal sheet.

- 30 14. Apparatus as claimed in claim 9 wherein the holes have a diameter at the front surface substantially equal to 3 microns.

15. Apparatus as claimed in claim 9 wherein the holes have a diameter at the front surface in the range of 3 to
35 7 microns.

16. Apparatus as claimed in claim 9 wherein each hole is defined by a generally tubular surface extending through the membrane, the tubular surface comprising a substantially cylindrical portion intersecting substantially at right angles with the front surface of the membrane and a flared portion merging smoothly with the cylindrical portion and increasing in aperture at a progressively increasing rate with respect to distance towards the rear surface so as to merge smoothly and
45 continuously with the rear surface.

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17. A method of dispensing a liquid as an atomised spray from a hand held dispenser including a casing body, a disposable housing removably engaged with said casing body, a mouthpiece and a vibratable perforate membrane engaged with said housing, comprising:

maintaining said liquid in said housing in contact with a rear surface of said membrane, said membrane defining an array of holes, each hole being flared such that the cross-section of each hole narrows in a direction from said rear surface towards a front surface of said membrane.

sensing inhalation at said mouthpiece with an inhalation sensor provided on said dispenser;

and vibrating said membrane such that droplets of said liquid are dispensed through said flared holes as an atomised spray into said mouthpiece.